The Mecheleciv

VOL. 17 MARCH 1958 NO. 4

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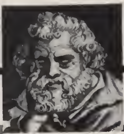
SCHOOL OF ENGINEERING
THE GEORGE WASHINGTON UNIVERSITY

MARCH 1958



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VOL. 17 MARCH 1958 NO. 4

SCHOOL OF ENGINEERING, THE GEORGE WASHINGTON UNIVERSITY

In This Issue:

ARTICLES

DEPARTMENTS

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Familiar Faces

DICK HAEFS was born in Oshkosh, Wisconsin, but moved to Washington and worked as a page in the U. S. House of Representatives. This gave him the opportunity of attending the Capitol Page School. When his days as a page were over he came to GW on a part-time basis while working as a Scientific Illustrator with the Department of the Interior, U. S. Geological Survey. His work gave him the background for an article, "Geologic Maps—An Engineering Tool," which appeared in the May '57 MECHELECIV.

Around GW Dick has held every office in Alpha Phi Omega, has served as president and treasurer of the Newman Club, treasurer of Sigma Tau, and treasurer and president of A.S.C.E. He was selected by the National Capital Section of A.S.C.E. as the outstanding C.E. student at GW for the past year.

Dick's plans for his career following graduation in June aren't too definite, but he thinks he might like to try his hand at technical writing.

DAN HAVENS is also a graduate of the Capitol Page School although he came originally from Lincoln, Nebraska. He worked as a page in the U. S. House of Representatives and later as a library assistant in the U. S. Supreme Court Law Library. He has also worked as an installer for Western Electric.

On campus, Dan has been a member of the A.F.R.O.T.C. Rifle Team and a member of the Cadet Activities Fund Board. He is presently serving as the A.I.E.E. representative to the Engineers' Council.

Dan, with the help of his partner in crime, Phil Pendleton, startled GWites the morning after the first Vanguard missile failure. Their realistic rocket was seen sticking nose down in the new snow and their vegetable-colander satellite with blinking neon lights was hanging high over the R. O. T. C. building.

Dan's hobbies are model building and electronics. As to his future plans, he thinks that he may stay in R. O. T. C., take a commission in the Air Force, and become a pilot.

BOB KEITH has spent quite a bit of time in the U. S. Army. Starting as a Private he was later commissioned and fought through the African Campaign, became a company commander during the Tunisian Campaign, and along the way picked up Bronze and Silver Stars. He was captured during the Sicilian Campaign but escaped and wandered through Italy for ten days before being recaptured. Bob spent almost the entire remainder of the war in Italian and German prison camps. Shortly before the end of the war he escaped again and this time made it all the way, but not before being captured by the Russians, recovering from a siege of pneumonia in a Russian hospital, and undergoing many other fascinating experiences.

After his discharge, Bob worked as a copy writer for Station WLS in Chicago for a while before reenlisting in the Army. After several more years of interesting service he decided to leave the Army and become an engineer.

Bob has been active in AIEE-IRE, has written for MECHELECIV, and is a member of Sigma Tau.

CLAIRE LEE CHENNAULT is known to practically all of the students of the School of Engineering because of her activities as Engineering Representative to the Student Council, or her participation in the Organization for Student Action which recently failed to obtain its probationary status, or simply because she's a girl in an almost entirely male student group.

Claire is from a military family. Her father, an Air Force Colonel, is now Chief of the Air Force Military Air Advisory Group in Madrid, Spain. Claire commutes via Military Air Transport Service every summer. Because of her father's frequent changes of duty, Detroit-born Claire attended schools in Arkansas, Texas, California, Montana, Germany, Alabama, and finally Arlington, Virginia.

She would like to be a writer but at present is content to concentrate on completing her engineering training. After getting her B. S. E. she would like to study languages for a couple of years at some Eureopean college with a preference at the present time for the University of Vienna.

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Applying the Area Rule To Transonic-Speed Aircraft

By Mickey Boothe, B.M.E. '58

THE problem of extremely high drag forces on aircraft operating in the transonic speed range has been recognized for a number of years. It was first established by laboratory wind tunnel tests at the time when the speed of aircraft began approaching sonic speeds. In 1947 the flight of the Bell X-1 at a speed greater than the speed of sound confirmed the extremely high drags associated with flight in this region.

Fairly substantial progress was made in reducing drag rise in transonic speed range by relatively obvious means. Swept-back and low-aspect-ratio wings were used, thickness ratios were reduced and fuselage shapes were optimized. These improvements permitted actual flights through the speed of sound but drag rise in the transonic speed range was still so large as to seriously compromise the performance of an airplane in accomplishing a useful mission. Actually drag rise was still so large that numerous designs for supersonic aircraft would not attain supersonic speeds. A new concept known as the "area rule" permitted some of these aircraft to easily attain supersonic speeds and thus be useful in accomplishing a mission. Here is presented a brief history of the area rule concept and a short discussion of how the designer uses it.

The research program which ultimately led to the development of the area rule originated as one of the National Advisory Committee for Aeronautics' basic research programs. There was no definite goal set for this program. Its purpose was to obtain more basic information on the nature of flow fields about wing-fuselage combinations. The research men of the NACA did, however, have several definite questions in mind. They were curious to know what transonic flow looked like and how transonic drag was produced. What was the shock pattern on simple wing shapes and body forms? Why did a transonic drag rise occur? How could airplane drags be computed; could component drags be simply added?

Pressure distribution measurements and Schlierens (a method of making shadow photographs of shock patterns) were made for a 45-degree sweptback wing-fuselage combination. The Schlierens showed the existence of a strong normal shock behind the trailing edge of the wing-fuselage juncture in addition to normal shock near the nose at near sonic Mach numbers. The geometry of the trailing edge shock was quite large compared to the wing-fuselage combination. It was reasoned that transonic drag rise was caused by losses resulting from this large shock.

Evaluation of the sources of the shock revealed that it was associated, to a large extent, with the interferences to the flow caused by the interaction of the various aircraft components, such as wings, fuselage and tail surfaces, one upon another. Actual experimentation showed drag at transonic speeds was caused by this plainly that the major component of aircraft interference and could not be explained in terms of the usual model configuration parameters such as thickness ratio, sweep and the usual fuselage shape considerations.

Further observations indicated that the shock formations at zero lift were similar to the expected shape of shocks around a modified streamlined body of revolution. Tests were made using a theoretically optimum streamlined body of revolution and a streamlined body of revolution with a swelling around its midsection representing

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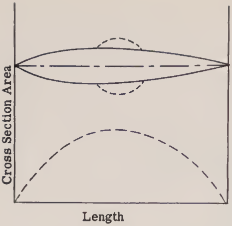


A body of revolution with its cross-sectional area distribution plotted below it. The swelling on the body, indicated by dotted lines, shows how a body of revolution can be made to duplicate the cross-sectional area of a wing-fuselage combination.

the cross-sectional area of the wing wrapped uniformly around the body. In this way the area change from nose to tail of a wing-fuselage combination was nearly duplicated by a body of revolution.

The lowest drag in the transonic speed region was recorded for theoretically optimum bodies of revolution. It was also discovered that transonic drag decreased in proportion to how closely the cross-sectional area of a winged fuselage resembled that of an optimum body of revolution.

While the results of these tests were studied other tests were made on a systematic series of wing-fuselage combinations. In order to evaluate the magnitude of wing-fuselage interference at transonic speeds, swept, unswept and delta wings were tested in combination with bodies having various amounts of curvature in the direction of their axis.

The results of these tests led to three principal conclusions:

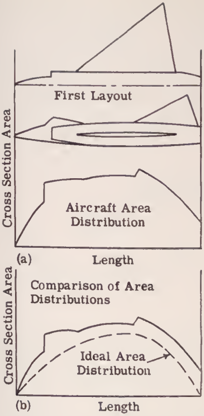
1. The effects of wing-fuselage interference are greatest at transonic speeds. In particular, effects of interference on the drag of wing-fuselage combinations may be very large.
2. Variations in the shape of the fuselage, general and specific, may lead to pronounced changes in the drag caused by wing-fuselage interference.
3. Drag of the wing and fuselage cannot be considered separately in determining the drag of the wing-fuselage combination at transonic speeds. The combination must be considered as a whole.

From these conclusions it was conjectured that interference drag, that is, shock losses resulting from the interference of the various aircraft components one upon another, was the largest source of transonic drag and depended primarily on the axial distribution of cross-sectional area normal to the streamlines about the aircraft.

Thus, interest having been particularly aroused in the flow phenomena involved with these interferences, flow studies made in connection with the general drag problem were re-examined. Two streamtubes were considered, one containing the wing-fuselage combination under study and the other a comparable body of revolution, that is, one with the same cross-sectional area distribution normal to the air stream. It was decided to examine the streamtubes at a circular section with the circumference outside the wing tips of the wing-fuselage combination. The flow was analyzed from station to station along the length of the bodies. Streamlines were observed to deviate around the nose, travel along the cylindrical body, deviate over the wing or swelling, close down over the rear of the body and eventually return to their original shape downstream. Variations of streamlines from a straight line pattern produces streamtube distortions in a radial direction in any plane normal to the center line of the body. There are two factors which tend to smooth out these distortions:

1. Pressure changes along the circumference of any streamtube in any plane normal to the center line of the streamtube, or body in this case. These pressure changes are caused by the change in velocity and cross-sectional area of the streamtube as it squeezes over the streamlined body. This pressure change tends to smooth out distortation bumps in the streamtube by influencing flow around the circumference of the streamtube.
2. The rigidity of the outer streamtubes. Acting like walls of a tunnel, a streamtube resist displacement of its boundary and therefore tends to smooth radial deviations in flow.

Circumferential and radial change in flow were found to quickly disappear as the flow gets away from the immediate vicinity of the body. Also, flow was identical for the two different bodies a short distance away from the bodies. Wind tunnel tests conducted on the model configurations considered in this flow analysis, through pressure distribution measurements and Schlieren photographs, reasonably justified the idea that drag is proportional to the cross-sectional area

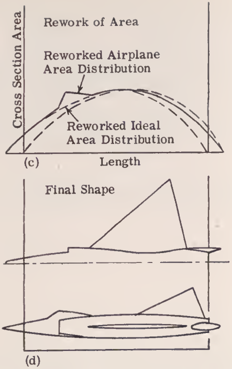


normal to the air stream. By decreasing the cross-sectional area of the fuselage in the region of the wing root by an amount equal to the cross-sectional area of the wing the streamtube pressure is relieved and shock reduced. Using this method, drag was reduced by as much as 60 per cent on airplane configurations which had approximately the same cross-sectional area normal to the air stream as an optimum body of revolution.

Thus a broad, simple new concept concerning interference drag was developed. This concept, known as the "area rule," states in essence that the transonic drag characteristics of wings, fuselages, tail surfaces and other parts of aircraft configurations are primarily a result of the combined total cross-sectional area distribution normal to the air stream of each configuration. Thus, the transonic drag of bodies of revolution as well as more complex configurations involving wings and tails would all have the same characteristics in the transonic drag problem provided cross-sectional area distributions remain unchanged.

To apply the area rule to an aircraft configuration the designer is confronted with four major steps:

1. For the first layouts the cross-sectional area, taken at stations along the axis of the fuselage, is plotted against the overall length of the aircraft.



This sequence of figures shows the four major steps the designer uses to apply the area rule to an airplane design.

2. The shape of this curve is then compared with the area distribution curve for an ideal or optimum body of revolution. The shape of the ideal body is derived mathematically.
3. The area distribution curve of the new aircraft design is then reworked until it agrees as closely as practicable with the shape of the curve for the ideal body. In order to do this it may be necessary also to rework the ideal body to make the two area distribution curves closely agree. For example, as shown in Figure 3, it may be necessary to increase the length of both the airplane and ideal body while at the same time maintaining the same maximum cross-sectional area of the ideal body.
4. The new area distribution plot is converted back to airplane cross-sections subtracting wing, tail and other component cross-sectional areas from the fuselage cross-section at each station. This may be done either by uniformly changing the fuselage radius or by local changes on the fuselage side.

The result is the optimum shape for minimum transonic drag. Though it may appear so, the designer's problems are not completely solved in these four relatively simple steps. It may be necessary to add area to the fuselage in

(Please turn to page 22.)

Is This What Your Car Needs?

Electronic Fuel Injection For Automobiles

By Jim Lear, B.E.E. '59

THE Bendix Electrojector is an electronically controlled fuel injection system for automobiles. It was designed by the Bendix Aviation Corporation, and is a low pressure, common rail system with timed intake port injection which provides each cylinder with a metered supply of fuel. It does not require a special drive from the engine, and therefore can be adapted to different makes and models of automobile engines. The designers claim a better distribution of mixture to the cylinders, improved torque and power output from the engine, better fuel economy, quicker cold starts and warm-up, and fast response to controls. Because of the elimination of the carburetor and air cleaner, the hood line can be four or five inches longer. The lower induction temperatures give a higher volumetric efficiency, and eliminate vapor locks in the fuel line due to hot spots in the intake manifold.

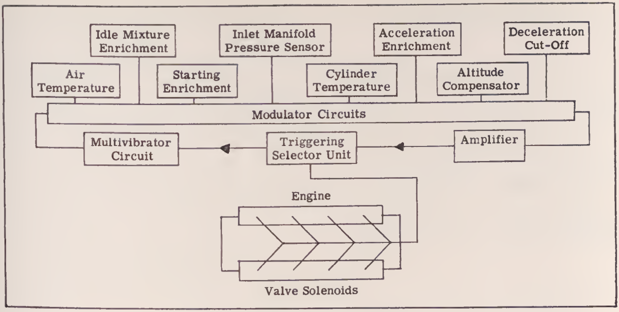
The system consists of an electronic modulator, a fuel injection distributing commutator, fuel injection breaker points, and special fuel injection nozzles.

The electronic modulator, in a 4" by 5" box, uses five transistors. These are used instead of tubes because they have no warm-up time and require low current. The electronic modulator transforms signals from a triggering selector unit into electrical pulses of a standard width. At the same time, signals are received from control units on various parts of the engine. By integrating these external signals into the standard pulse width circuit of the electronic control system, the pulse width is modified to reflect engine conditions. The modified pulses are amplified and then sent to the proper injectors by the distributing system.

The commutator and breaker points necessary for distribution of the amplified pulses from the electronic modulator can be installed on any conventional distributor. The distribution breaker points and engine ignition points are actuated by the same cam. Each time the fuel injection breaker points make contact a triggering impulse is transmitted to the electronic modulator unit, where it is modified and returned to the selector portion of the assembly for direction to the correct fuel injector. Engine speed is sensed through the triggering unit. Each cylinder receives an injection charge once during every two engine revolutions. The addition of the unit to a standard distributor increases its height by only one inch.

In the Bendix Electrojector system, use of a common rail fuel supply line and injection at the intake ports overcomes the problem of fuel line inertia. In a multiple pump system, at high speeds, starting fuel delivery by the spray nozzle at the end of a two-foot line may lag over forty crankshaft degrees.

Fuel is supplied from the gas tank by an electric, non-metering fuel supply pump, which maintains pressure in the common rail system at 20 psi, plus or minus ½ psi. A fuel return line is included in the system to continually purge any air or fuel vapor from the fuel injection system. A constriction in the return line helps maintain the necessary pressure. Between the fuel pump and the injectors there is a fuel filter. Because the Bendix Electrojector system contains fewer moving parts than other fuel injection systems, and close tolerance machining is not required, it is not necessary to have a fuel filter finer than 20 microns particle size.



The Bendix Electrojector System

Experience has shown that best results are obtained when the fuel is directed at the head of the intake valve, for minimum wall wetness. The fuel from the common rail supply enters at the top of a solenoid fuel injector valve and passes through its center core, discharging through the nozzle at its lower end when the valve is open.

The operating cycle of the system is as follows:

As the engine rotates, the injector breaker points transmit signals in time with the opening of each intake valve to the electronic modulator unit. A multivibrator circuit in this unit is triggered by these signals, setting up a series of pulses of a standard width. The length of these pulses is then modified by signals from various sensing and control units, such as the intake manifold presure sensor, the deceleration cut-off control, the starting enrichment control, the idle mixture enrichment control, the acceleration enrichment control, and the altitude compensation control. This modified pulse is then amplified and sent to the proper injector unit by the distributor unit. Solenoids in the injector units react to the impulses and open the valves, permitting the required amount of fuel to enter the cylinder. As the resistance of the sensing circuits increases, pulse width increases, holding the solenoid operated valve open longer and permitting additional fuel to enter the cylinder.

Throttle valves similar to standard types, but larger, are used to control airflow to the engine. Attached to the throttle body are the manifold pressure sensor, the deceleration cut-off control, the starting enrichment control, the idle mixture control, and the acceleration enrichment control.

The intake manifold pressure sensor varies the resistance of a non-linear potentiometer to indicate the relative density of the air entering the engine. The resistance characteristic of this potentiometer varies for different makes and models of engines.

The deceleration cut-off control senses the abnormally high manifold vacuum caused by deceleration and acts to reduce the fuel supply to the engine. The cut-off is extremely rapid because there are no mechanical or hydraulic lags. The amount of unburned fuel in the exhaust is kept to a minimum, reducing air pollution and smog problems.

To provide the additional fuel needed to start a cold engine, a thermostat positions a variable resistance so that its resistance increases as the temperature decreases, increasing the pulse width and therefore the length of time that the solenoid actuated valves remain open. To obtain added fuel during the cranking period, a solenoid operating through the thermostat repositions the variable resistance to a higher value during the cranking period. A conventional fast-idle cam and thermostatic mechanism provide fast-idle speeds during the warm-up period.

A rheostat is connected to the throttle shaft to include a variable resistance in the control circuit when the throttle is in the idle position. The idle speed of the engine is controlled by adjusting this resistance instead of a conventional adjustment needle.

When the engine accelerates, a small additional amount of fuel is necessary for the engine

(Please turn to page 24.)

Engineering Aspects of Highway Design

By Bob Reining, B.C.E. '58

This article was written for a definite purpose. It will take a reader only a few minutes to digest the content and yet I believe that the time so expended will prove to be both enlightening and valuable. As a civil engineering student in this age of missiles and satellites I feel that the time has come to call the attention of the general public to the modern role of the oldest engineering profession. I am constantly appalled at the lack of knowledge displayed by both technically and non-technically educated people when it comes to understanding the civil engineering profession. Almost any trade journal or newspaper in print today carries large advertisements for engineering jobs, mostly in the electrical and mechanical fields. I believe that, as a consequence of this advertising emphasis, the general public has been led to regard the civil engineer as a member of a dying profession.

Since I believe that an article which attempted to encompass the role of the civil engineer in the missile program would be of little interest to those outside of the profession, I shall not dwell on this subject. Be assured, however, that such a role exists and that it is both indispensable and vital. Instead, I shall attempt to acquaint you with another phase of civil engineering, Highway Engineering. This subject concerns the general public greatly and it is one which had developed in the last thirty years from a limited field to a complicated and intricate science.

Within the past few months, the 1958 model automobiles have been introduced and are now available to those inclined to spend from $1,500 to $10,000 to obtain the make and model of their choice. With the coming of warmer weather and vacation time, almost the entire populace will take to the roads to enjoy vacations at numerous resorts and private spots over the hemisphere. 1954 statistics indicated a vehicle census of one for every three persons in the United States—an ample supply to transport the entire population simultaneously. In the twelve years since World War II this country has enjoyed the opening of many new superhighways, designed to furnish direct arteries to important centers. The motorist can now, and will more and more as the Federal Aid Program is expanded, enjoy 60 mph travel to many points. The flaw in the picture is the rising rate of driving fatalities.

A primary aim of the superhighway systems is to reduce the fatality rate while increasing highway capacity and legal speed limits. This article will confine itself to the subject of a modern superhighway. It will present in elementary form the major problems and considerations of highway design and construction and it will develop the important requisities of a safe, well-designed highway.

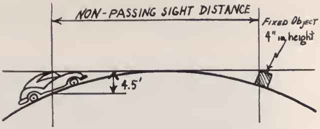
I believe the best method of illustrating the effort required to open a public highway such as the New Jersey Turnpike or the shorter Baltimore-Washington Parkway is to trace the progress of a sample highway from the planning stages to the day the tape is cut and traffic begins to roll.

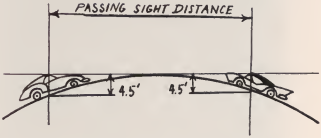
Certain assumptions are necessary to get started. Let us assume first that the necessary funds for the project are available and, second, that traffic surveys have indicated a definite need for the project. With this much to go on, we will proceed to develop the project, making comments and explanations where necessary.

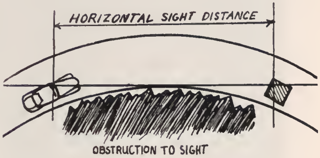
Given our destination points, the first step is to select a route. Surveys must be made and several alternate routes selected. Each alternate must be carefully studied so that the most favorable will be selected. Primary considerations are the mileage, the cost of obtaining right of way and the estimated construction costs of each alternate. While on one hand the land contours may call for a minimum of earth-moving, the right of way costs over that route may be prohibitive. Often the purchase of right of way will run to thirty or forty percent of the construction costs. As an example, the California Department of Highways spent 31 million dollars for right of way purchase and 82 million dollars for construction in 1951-52.

The process of selecting the final location for the project is far from simple. Most projects call for a detailed economy study from which the final location is selected on the basis of overall economy.

Once the final location has been selected, the route must be extensively surveyed. The designer must have information on land elevations and composition for every foot of the project. Test bores will be necessary to determine the amount of rock which must be excavated. When the information so obtained has been collected in a single document, teams of designers go to work to select a final centerline grade consistent with economy and rigid safety minimums. The next step is the design of embankment cross sections which will serve for the roadway prism. The characteristics of the embankment or prism cross section at any point depend on the conditions existing on the centerline grade at that point. A project of any length will pass through many different land contours and soil conditions; over hills, through deep rock cuts, along broad damp flood plains and often through damp low swamps. Drainage and the accurate control of soil moisture content in the roadway prism is always a problem. Damp soils are unstable and subject to excessive heaving and frost action. In the northern United States, even where the ground seldom freezes more than 2 or 3 feet below the surface, heaving or raising of the road surface by 6 inches or more is not uncommon. In one case heaving of two feet has been reported. Drainage is a problem which demands that an average of twenty-five cents of the construction dollar be spend on hydraulic structures to insure that the project will remain in satisfactory condition even in extreme weather. Soil Mechanics plays a large part in the design of highways and it is not uncommon that large amounts of material may have to be removed and replaced with soil whose hydraulic properties and strength in bearing are adequate to support the imposed loads. As an example, when a project passes through a swamp it is usually necessary to muck out the unsuitable material down to hardpan or an impervious layer and replace such material with clean fill.







I have illustrated in this article only four elementary principles which the designer must include when he produces the final blueprints. These are primarily safety factors which are built into modern highways for the protection of the highway user. A large amount of research has gone into driver characteristics and vehicle potentialities, and modern design specifications are based on the findings of this reesarch.

The concept of sight distances over crests and around curves is an interesting one. The designer thinks in terms of two definite types of sight distance. Non-passing sight distance is the longest distance at which a driver whose eye is four and one-half feet above the road can see an object four inches high on the ground in front of him. Passing sight distance is the greater. It is the longest distance that a driver whose eye is four and one-half feet high can see the top of an object four and one-half feet high on the road. As seen by the diagrams, this concept

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When the program reaches its peak, some 2,000 to 3,000 Western Electric engineers will attend each year . . . studying in an atmosphere as close to a university graduate school as is practical for industry.

This engineering "university" was born because of the ever-increasing complexity of Western Electric's job as the manufacturing and supply unit of the Bell Telephone System. Today W. E. engineers are right in the middle of exciting fields like microwave radio relay, electronic switching and automation. Graduate engineering training is designed to spur their development and advancement throughout their entire careers.

How Graduate Engineering Training would work for you

The program gets under way after approximately six months on-the-job experience. First off:

1. A nine-week *Introduction to Western Electric Engineering* helps you learn about your W.E. engineering field, sharpens your skills in getting ideas across. Technical subjects include communications systems, product design principles, military electronic systems.
2. Another nine-week program, *General Development*, starts after your first year with us, helps broaden and strengthen your engineering background. Besides technical subjects like engineering statistics, measurements and instrumentation, and electronics, you receive grounding in human relations and the socio-economic importance of engineering.
3. To meet continuing needs for formalized technical training, *Advanced Development* offers four-week courses tailored to the individual needs of the engineers selected to attend. These courses are designed to help develop creative engineering abilities. Computer applications, switching theory, feedback control systems, and semi-conductor devices and circuits are sample topics covered in this phase.

Besides taking part in the Graduate Engineering Training Program, engineers are eligible for our Tuition Refund Plan for after hours study at nearby colleges.

In short, there's a unique opportunity at Western Electric to develop a professional career . . . and work in the exciting world of communications.

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

Knowledge born in the classroom often sparks on-the-job ideas. These engineers are working on transistor manufacturing problems.

OPPORTUNITIES FOR ENGINEERING GRADUATES

(Supervisory and administrative opportunities exist in each field)

Analysis for manufacturing operations:
Machine and tool requirements—M.E., E.E.; Space requirements—M.E., I.E.; Test facility requirements—E.E.; Personnel requirements—I.E.; Electric power, light and heat requirements—E.E.; Raw material requirements—Chem. E., Met. E., Phy. Sc.; Procedures and processes—M.E., I.E., Time and motion studies — I.E., Investigation of manufacturing difficulties—M.E.; Quality control—M.E., E.E.

Planning telephone central offices:
Equipment requirements — E.E.; Power and cable requirements—E.E.

Development and design:
New machines and tools—M.E., E.E.; Material handling methods—M.E., I.E.; New equipment and processes—M.E., E.E.; Repair shop methods—M.E.; Testing facilities—E.E.; Testing methods—E.E.; Job evaluation studies—I.E.; Wage incentive studies—I.E.; Production control studies—I.E.; Improved chemical processes—Chem. E., Met. E., Phy. Sc.; New application for metals and alloys—Chem. E., Met. E., Phy. Sc.; Raw material test procedures—Chem. E., Met. E., Phy. Sc.; Service to military on electronic devices—E.E.

For further information write: Engineering Personnel, Room 1030, 195 Broadway, New York 7, N. Y.

• Western Electric has major manufacturing plants at Chicago and Decatur, Ill.; Kearny, N. J.; Baltimore, Md.; Indianapolis, Ind.; Allentown and Laureldale, Pa.; Burlington, Greensboro and Winston-Salem, N. C.; Buffalo, N. Y.; North Andover, Mass.; Lincoln and Omaha, Neb.; St. Paul and Duluth, Minn. Distribution Centers in 32 cities. Installation headquarters in 16 cities. General headquarters: 195 Broadway, New York, N. Y. Also Teletype Corp., Chicago 14, Ill.

Muzzle Page

with Frank Narr

Here are more amusing and puzzling braintwisters, so "Good Luck!"

1. Monkey Business

If a monkey climbs a pole that is 10 feet long and advances 1 foot each time that he moves his arms and legs, and slips back 6 inches after each advances, (a) How many movements would he make to touch the top, and (b) How far would he have climbed had he gone straight up without any lost motion?

2. Who Pays the Bill?

Three gentlemen went into a night restaurant and after sampling everything in sight, they got into a mild argument as to which one had the most cash. None of them wanted to reveal the amount of his assets, so they called over the waiter to act as referee and settle the dispute. He found that A's money and ½ of B's added to 1/3 of C's came to just $32; again 1/3 of A's with ¼ of B's and 1/5 of C's made $15; and finally that ¼ of A's together with 1/5 of B's and 1/6 of C's totaled $12. How much did each one have?

3. Oh, My Pretty Clementine

The country spark that asked the charming she
How many years of age that she might be,
Again asked her to tell him in all haste
How many inches she was around the waist.
"My waist is such if multiplied by four,
Four-fifths of product add on my age more—
The square root of three-fifths of this is six.
Now find my waist and get out of this here fix."

4. Oh to Be a Farm Boy

Two betting gentlemen who we shall call Y and Z were so journing at a farmer's house in the country. On taking a stroll one evening they met the farmer's daughter, whom we shall call X, because she, like the boarders, was an unknown quantity, and she was carrying a pail of milk on her head. They made a bet as to how much milk the bucket contained, Y exclaiming it was half full, and Z that it was not half full.

Approaching the maiden they asked her if they might be permitted to take a look into the bucket, which privilege she readily granted them. They they found they had nothing to measure the milk with, but one of them who had a country school teacher before he became a city slicker and hence knew all about water and buckets and things, found a way to roughly measure it. How did he do it?

5. Busy Texans

Two mavericks that had been cut out of the herd from the panhandle country in Texas journeyed to New York City to see the skyscrapers and the sights on the roofs thereof. On arrival, A had $100 and B had $48. They were walking arm in arm up that part of the trail which was known in the Roaring Twenties as the Rialto when suddenly a bobbed hair bandit stepped out in front of them with a six gun and said in a low, gentle, persuasive voice, "Elevate and donate or I'll shoot your gizzards into next week."

Considering she was a young lady, together with the other circumstances heretofore described, they forked over their belongings willingly. The hold-up girl took twice as much from A as she did from B, but she left to A three times as much as she did to B. How much did she take from each?

ANSWERS TO DECEMBER PROBLEMS

1. Manager—Mrs. O'Riley
   Asst. Mgr.—Mr. McDonald
   Cashier—Mr. O'Connor
   Stenographer—Mr. St. Patrick
   Clerk—Miss Sullivan
   Teller—Miss McFee
2. 15 miles
3. Jack - Sylvia
   Mark - June
   Simon - Barbara
4. 821 yards
5. A cousin
6. Yes, in fact he could walk under it since the wire would be almost 16 feet from the ground.
7. 9 tires
8. Rastus
9. Gains 5/11 min. every 65 min. or gains 1 hour every 143 hours.
10. 6/7 inch

RCA ELECTRONICS KEEPS A RADAR "WEATHER EYE" ON YOUR COMFORT ON THE GREAT AIRLINES

Flying into a starless night, the pilot's vision may reach a mere 50 yards. Yet he sees a storm brewing 150 miles ahead.

Within minutes he plots a slight change in course and flies a smooth, safe corridor *through* the weather. His passengers complete their trip in comfort and on schedule.

Credit RCA Electronics for the "Weather Eye" radar that makes all this possible. And United Air Lines' all-radar fleet for being the first (among 24 leading airlines) to use this important development.

RCA pioneering also produced radar that guides ships at sea and tracks man-made satellites through space. RCA pioneered color television, produced the world's largest electronic computer, peanut-sized transistors and much, much more.

Progress like this helps explain why RCA *means* electronics — and why electronics means a happier, healthier, more secure future for you.

RCA RADIO CORPORATION OF AMERICA

WHERE TO, MR. ENGINEER?

RCA offers careers in TV and allied fields — in research, development, design and manufacturing — for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. Join the RCA family.

For full information write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, New Jersey.

NEWS IN INDUSTRY

NEW RADAR TRACKING SYSTEM

A radar track-while-scan system, which automatically tracks up to 72 targets in three dimensions, has been developed by Westinghouse Electric Corporation. This is a hybrid ditigal-analog system in which error sensing is a completely analog function accomplished under the control of a digital computer which computes, controls and displays information on all 72 tracks. The result is a reduction of equipment required and an increase in accuracy of track over ranges considerably in excess of other types of tracking systems currently undergoing test.

The three-dimensional information in the track-while-scan system course directly from a single radar source. In addition, individual monitors for each track are provided, and automatic track fault alarms permit one operator to successfully monitor 12 tracks. The computer components are made up of plug-in package units, using printed circuits and all static components.

Rack of printed circuits used in 72-target tracking system.

300-million candle power providing beacon for planes leaving National Airport.

WASHINGTON'S SKYWAY TRAFFIC LIGHT

A 300-million candle-power beam of light has been installed near the Washington Airport to direct aircraft away from nearby heavy populated areas. A 2500-watt short-arc mercury lamp, developed by Westinghouse, produces the light for this "skyway traffic light" to be operated by Federal Airways.

The unusual aspect of this aerial beacon is that the pilot does not actually see the light itself. Instead, he sees a high-intensity reflection of the light from moisture and dust particles in the air. This resulting column of light rises skyward about seven and a half miles beyond the end of the runway and is tilted toward the planes at an angle of 25 degrees from the vertical position.

As planes take off from the Washington airport at night, they follow a normal flight pattern until they see the beam. Then they fly directly toward the beam which leads them up the Potomac River away from the heavily populated areas. This greatly reduces the noise level of the planes in the residential areas.

In the short-arc lamp, originally developed for Navy signalling apparatus, the arc is compressed to a fraction of an inch. The lamp becomes a brilliant, high-intensity point source of light having the operating simplicity of a light bulb.

It is the brightest, continuous-burning man-made light source available. Its characteristics also permit completely automatic operation for long periods of time by remote control.

AREA RULE

(Continued from page 11.)

some places and subtract area in others. In the case shown, in order to make the airplane area distribution conform to the area distribution of the ideal body, it was required that area be added to both the nose and aft sections and subtracted from the midsection.

In order to accomplish these steps the designer may have to make certain compromises to meet the specifications for the airplane design. For example: cockpit visibility requorements must be met; if the aircraft is to be carrier based its size may be limited by the elevator size on the aircraft carrier; the fuselage cross-section must be large enough to house the engine, which is one reason why the ideal body may have to be lengthened as described above; provision may have to be made for the addition of an afterburner at a later date. These things and many more may seriously affect the final cross-sectional area and overall length requirements. The additions in cross-section area which are sometimes necessary allow the designer some valuable extra volume in the fuselage which can be used to house necessary aircraft equipment. An example of this is the long nose and tail blisters on the Convair F-102A

The final shape of aircraft designed to conform to the area rule concept shows a curious fuselage indentation which has erroneously been labeled "coke bottle," "Marilyn Monroe" and "wasp waist." This indentation, or decrease in the fuselage width in the region of the wing root, is quite pronounced in the photograph of the F-102A

A powerful, useful, simple tool is provided by the area rule in eliminating interference drag because it permits the use of design information on theoretically optimum bodies to be applied to the design of airplane-like configurations having similar optimum drag characteristics. The area rule has reduced to a graphical procedure the detailed analysis which previously has been required whenever the effects of wing geometry such as thickness, sweep and aspect-ratio were involved. Such analyses were always clouded by the effects of other variables which could not be evaluated.

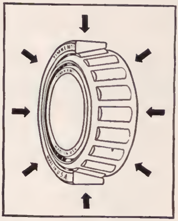
The Grumman F11-F1 was the first airplane to which the area rule concept was applied. It was also the first airplane to exceed sonic speed in level flight. Curiously enough, when designed to conform to the area rule, the F11F-1 required approximately 25 per cent less power to fly at supersonic speeds than was called for in the original design. Even more remarkable was the increase in performance of the Convair F-102. This airplane was originally designed as a supersonic craft; however, it would not attain supersonic speed. When redesigned in conformance with the area rule (and redesignated the F-102A) it attained supersonic speeds in a climb.

Thus, the area rule has proved to be a simple and useful method of reducing greatly the sharp increase in wing-fuselage drag associated with flight at transonic speeds. It has made possible the rapid acceleration of aircraft through the transonic speed range and the attainment of supersonic speed with less power than previously required.

Tear out this page for **YOUR BEARING NOTEBOOK...**

How to make a good grade with a scraper

Huge 518 hp. scrapers like this often have to maneuver giant loads on hills—up, down and sideways. Engineers who design these mammoth earth movers have to provide for the terrific, combination radial and thrust loads, plus shock loads. To take the loads and assure dependable scraper performance engineers mount wheels, pinions and differentials on Timken® tapered roller bearings.



Tapered design lets Timken® bearings take both radial and thrust loads

Not all bearings can take loads from the sides, as well as from above. The tapered design of Timken bearings lets them take *both* radial and thrust loads in any combination. And because Timken bearings roll the load on a full line of contact between their rollers and races, they have extra load-carrying capacity.

Want to learn more about job opportunities?

Timken bearings help make better machines. And better machines make our lives richer, give us more leisure time. We call it Betterness. Why not find out more about Betterness and how you can help create it. Write for: "BETTER-ness and Your Career at the Timken Company". The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

ELECTRONIC FUEL INJECTION

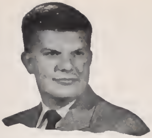
(Continued from page 13.)

to maintain smooth operation over the transition period. A rapid change in manifold vacuum causes a pressure sensitive switch to operate, inserting extra resistance into the circuit for the time necessary for pressure in the switch housing to equalize.

An additional feature is the altitude compensation control attached to the main control box, which decreases resistance linearly as altitude increases to shorten the control pulses and maintain a constant fuel-to-air ratio. This control is operated by an aneroid pressure sensing device, so it will also adjust for barometric changes.

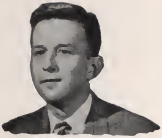
Thermistors are located in the water jackets of each cylinder to sense and transmit temperature data to the electronic modulator for maximum performance during the starting and warm-up periods. Also, a thermistor may be placed in the air intake passage to sense the temperature of air entering the cylinders.

Tests of V-8 automobile engines at speeds from 20 mph to 70 mph show that these engines gave better gasoline economy when equipped with the Bendix Electrojector system than when equipped with four-barrel carburetors.



Pump-turbine design is now the work . . . hydraulics, the field . . . of John Jandovitz, BSME graduate of College of City of New York, '52.

Water conditioning chemical, service, and equipment specialist in Houston is new assignment of Arthur Brunn, BS Chem. E., University of Tennessee, '56.



Field sales engineering of America's widest range of industrial products is choice of Roy Goodwill, BSME, Michigan State College, '54.

Recent Training Course Graduates

select wide choice of careers at Allis-Chalmers

Starting up a cement plant in Mexico after coordinating all work on it is latest job of John Gibson, BS Met. E., University of California, '54.

Nucleonics is chosen field of R. A. Hartfield, BME, Rensselaer Polytechnic Institute, '53. Currently he is working on design and development of new nuclear power plant.

THERE'S variety at Allis-Chalmers. Whether you're thinking in terms of types of industries, kinds of equipment, types of jobs, or fields of work, the diversification of Allis-Chalmers provides unsurpassed variety. For example:

Types of jobs	Industries	Equipment	Fields
Research	Agriculture	Tractors	Metallurgy
Design	Cement	Kilns	Process Engineering
Manufacturing	Chemical	Screens	Mechanical Design
Application	Construction	Earth Movers	High Voltage Phenomenon
Sales	Electric Power	Transformers	Stress Analysis
	Mining	Crushers	Nucleonics
	Nuclear Power	Reactors	Electronics
	Paper	Control	Hydraulics
	Petroleum	Pumps	Acoustics
		Motors	Thermodynamics
		Steam Turbines	

An outstanding training program, started in 1904, is designed to help you find the activity within these groupings for which you are best suited. Up to two years of theoretical and practical training are offered. Direct employment at Allis-Chalmers is available for those with sufficient background.

Learn more about Allis-Chalmers and its training program. Ask the A-C district office manager in your area or write Allis-Chalmers, Graduate Training Section, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

HIGHWAYS

(Continued from page 15.)

applies both to crests and curves and to combinations of the two. Codes proscribe the specifications for these distances, and dictate in turn the allowable grades and curvatures. These concepts are minimums which the designer must incorporate in his work. Codes likewise proscribe minimum lane and shoulder widths.

The concept of superelevation or "banking" is one which was adopted from railroad practice as vehicle speeds increased so that the tendency of vehicles to skid or spin out of high speed curves thereby increased. Properly superelevated curves incorporating easement spirals on both ends provide safety and comfort to the 60 mph driver. A properly superelevated curve decreases the likelihood of a skid even under adverse weather conditions.

These factors are only a few of the many considerations which must be incorporated in highway design. Large amounts of time and money have been expended in materials testing and research. Two general types of surface material predominate today. These are bituminous and concrete. Both types have particular advantages and disadvantages so that in the long run it is usually economy that dictates the final selection. To illustrate, bituminous pavement was used on the New Jersey Turnpike. Since it passes through the large petroleum complex and is in proximity to the Port of New York, asphalt and oils used in bituminous pavement were more cheaply obtained and therefore it was an economical choice.

Mention should be made of the *controlled access* principle—the name that engineers and planners use to denote a facility that is fully controlled by the administrating agency. This means that admission or departure from the highway takes place only at points designated by the agency. Contiguous property owners do not have free access to the highway. Controlled access has been proven to achieve two very desirable aims: First, it insures a free flowing volume of traffic; and second, accident opportunity is markedly reduced. To illustrate the vast difference between free and fully controlled access one need only compare two nearly adjacent facilities. For those familiar with this area a simple yet striking comparison may be made. The Baltimore-Washington Parkway is a controlled access facility. U. S. Route 40 from Baltimore to New Castle, Delaware, is a well-designed facility but is totally lacking controlled access. The money spent on this project is half wasted and the basic purpose of the improvement is compromised. A driver on the Baltimore-Washington Parkway may proceed in comparative safety by either night or day; however, if he moves by night he would do well to stay clear of U. S. Route 40. A driver on U. S. Route 40 is liable to pick up in his headlights the broad side of a moving van stretched across his path. Vehicles may enter Route 40 by any one of numerous small unmarked access roads. Route 40 is a good facility rendered unsafe by commercial encroachment.

Finally, the entire project is tied down with a final blueprint and a proposal containing the specifications for the materials to be used and the methods to be employed. In final form, these represent the best available materials and practices currently approved and adopted for use. Invitations are sent to interested contractors to bid for the job. The contract as a rule is awarded to the lowest bidder who can meet the requirements set forth by the agency issuing the invitation to bid. Construction can then begin, and before too many months have passed the public is the beneficiary of top-notch engineering effort.

Thus we have briefly surveyed the cooperative effort of hundreds of engineers, technicians, administrators and economists. Before the project is finally approved, it is thoroughly inspected by engineers to insure that it meets the high standards demanded by the plans and specifications. Every step of the construction is inspected as the work progresses. The contractor is not allowed to bury his mistakes. Close quality control is maintained throughout the job.

The net result is the finest type of facility that money can buy. If the planning is adequate, fully controlled access is achieved and public welfare and safety are not compromised for commercial interest. Here the responsibilities of the civil engineer are weighty and his role is a challenging one.

One final word, without which no article on modern highway development would be complete. Modern highways are designed for travel at speeds which will be consistent with safe operation and economy. In this connection it is unlikely that we will see highways designed for high capacity on which the legal speed limit exceeds 60 mph for a long time to come. Modern superhighways have overtaken the driver in that designs have exceeded the capabilities of the average vehicle operator to capitalize on them. This does not mean, however, that the modern superhighways are foolproof. A highway is a facility designed to be used by human beings and no highway, no matter how well designed and constructed, is more foolproof than the worst fool who uses it.

Emblem Contest Deadline Extended

The engineers emblem contest deadline has been extended to April 30. The contest was established to obtain an emblem for the School of Engineering. Anyone may enter as many designs as he wishes. Prizes are: one ticket to the Engineers' Banquet and Ball on May 10, a carton of Marlboro or Philip Morris cigarettes, and a certificate. All participants will receive a letter or certificate in recognition of their effort. All entries are to be colored or are to have the colors designated and are to be placed in the box on the hall table in the Davis-Hodgkins House at 731 22nd St., N. W. A short explanation of the symbolism used would also be helpful.

Entries received to date indicate a lot of thought and artistic skill went into their creation. However, it's not too late to submit your idea. It could be the winner.

Engineers Sponsor Social Events

The Engineers' Council is co-sponsor with the Dance Department of a square dance to be held April 18. The dance committee has not established the location as yet but, barring bad weather, the dance will probably be held on Lisner Terrace or on one of the newly surfaced parking lots. Free soft drinks will be furnished. An expert knowledge of the intricacies of the square dance is not needed. Beginners are welcome.

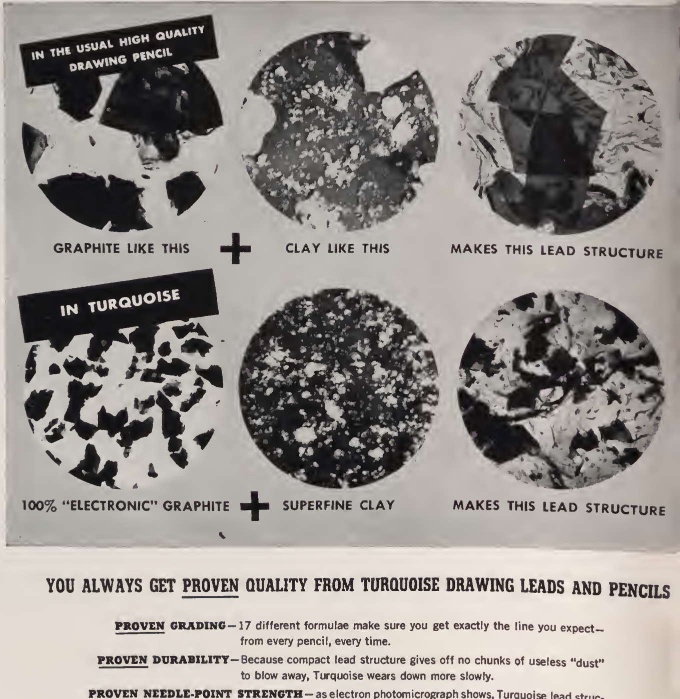
The big event of the School of Engineering social year, the Engineers' Banquet and Ball, is scheduled for May 10 at the Presidential Arms. Couple tickets are priced at a very reasonable $10.00 and are available from any Engineers' Council member.

MECH - MISS

Photo by Tom Beole

For the benefit of hi-fi enthusiasts, the background for our March Mech-Miss is a Capozio Speaker Cabinet from Schrader Sound of Georgetown. For the benefit of readers interested in more basic things, the pretty platter spinner is Miss Joan Ramage, a 20-year-old Kappa Kappa Gamma. Joan is a junior transfer student from the University of Connecticut. She lives in suburban Maryland and is majoring in zoology.

Now you can **see** why only
leads & pencils give you perfectly



YOU ALWAYS GET PROVEN QUALITY FROM TURQUOISE DRAWING LEADS AND PENCILS

PROVEN GRADING—17 different formulae make sure you get exactly the line you expect—from every pencil, every time.

PROVEN DURABILITY—Because compact lead structure gives off no chunks of useless "dust" to blow away, Turquoise wears down more slowly.

PROVEN NEEDLE-POINT STRENGTH—as electron photomicrograph shows, Turquoise lead structure is finer—and therefore stronger. It holds a needle point under drawing pressures for long lines of unchanging width.

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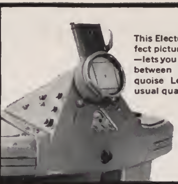
Eagle Turquoise sharp drawings



This Electron Microscope takes perfect pictures 7,500 times actual size—lets you see the startling difference between Eagle's "Electronic" Turquoise Lead and the lead in the usual quality drafting pencil.

Photographs courtesy of Ladd Research Industries, Inc.

...AND MARKS LIKE THIS

Relatively large, irregular particles of graphite make a rough-edged line. Drawings will be inferior.

...AND MARKS LIKE THIS

Tiny, more uniform particles deposit as a clean-edged, solid line. Drawings will be perfectly sharp, clearly defined.

WRITE FOR FREE SAMPLE DEMONSTRATION KIT
(including Turquoise wood pencil, Turquoise lead, and Turquoise "skeleton" lead) naming this magazine. Eagle Pencil Company, 703 East 13th Street, New York, N. Y.

• **TURQUOISE DRAWING PENCILS:** ®"Electronic" graphite. 17 grades, 6B through 9H.

• **TURQUOIS CLEANTEX ERASER:** Super-soft, non-abrasive rubber.

• **TURQUOISE DRAWING LEADS:** Fit any standard lead holder. Grades 5B through 9H.

• **TURQUOISE LEAD HOLDERS:** Hold any grade of Turquoise lead.

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PENCILS AND LEADS

are the largest-selling in the United States!

Alumviews

Plan to Attend Annual Luncheon Saturday, April 26

The Annual Alumni Luncheon will be held this year at the Willard Hotel, Washington, D. C.

Mr. Charles S. Rhyne, LLB '37, President of the American Bar Association, will be the featured speaker. He will talk on University growth and development.

Scheduled for 12:00 noon, the Luncheon program will include awards of distinction to faculty members serving the University for twenty-five years. Faculty members to be honored are: Samuel Mayer Dodek, Associate Clinical Professor of Obstetrics and Gynecology; Addison McGuire Duval, Clinical Professor of Psychiatry; Chester Elwood Leese, Professor of Physiology; William Henry Myers, Educational Coordinator and Professor of Physical Education for Men; Leland Wilbur Parr, Professor of Bacteriology; and Gretchen Louisa Rogers, Associate Professor of German.

Write the Alumni Office for hotel reservations April 26th. Your University is proud of its growth. Why don't you visit Washington and see for yourself.

HARRY M. BRANDLER (B.E.E. '55) is a Consulting Field Engineer with the Standard Electric Time Co. This work entails his traveling the whole U. S. but is very enjoyable and profitable according to Harry. He and his wife were blessed with a baby boy last August, David Joseph. Harry's home address is 107 School Street, Springfield 5, Mass.

J. W. (BILL) GRADY has written a couple of newsy letters which we were waiting to include in a larger Alumviews section but a few of his remarks might be used here. Bill is presently on assignment in Germany (U. S. Naval Forces, Germany, APO 757, New York, New York) and has moved his family over there with him. They are living in Frankfurt but Bill travels frequently in connection with his work and mentions being in most of the major spots in West Germany, as well as Holland, Switzerland, Paris, and Austria.

ROBERT H. VAN SICKLER, Lt., USAF (*B.M.E., '55*) is presently assigned to Hsin-Chu, Taiwan, as a controller for the TM 61-C. Bob says that he enjoys living in China and is looking forward to the remainder of the tour. His present address is 17th TACMISSILERON APO 140, San Francisco, California.

CHARLES WIMBROW (B.S.M.E. '51) has been employed for the past six years in the Engineering Department of The Dow Chemical Company, Freeport, Texas. He presently holds the position of Utilities Section Engineering Manager and supervises a group of project engineers who handle all of the Texas Division service and power projects. He passes the word along that Dow is a fine employer and he heartily recommends the company to any engineer who might like to move to Texas. He is now living at 115 Chinaberry, Lake Jackson, Texas.

J. HAROLD LINK (B.S. in E.E. '40) is employed as an Electrical Engineer in the Interior Communications Branch of the Bureau of Ships, Navy Department. His work is in the field of Ship Metering and Indicating Systems. His present address is 5631 Knollwood Road, Washington 16, D. C.

BERNARD BERNSTEIN (B.S. '42, B.M.E. '47, M.S. '54 Maryland) is now General Manager of the Ordnance Systems Division of Gulton Industries, Metuchen, New Jersey. The Division is engaged in fuzing systems for missiles, sonar systems, and A.E.C. projects. Bernie is living at 522 Pemberton Ave., Plainfield, N. J., and would like to hear from former fellow students and students who studied under him while he was teaching at G.W.U.

TO: ALUMNI EDITOR

Mecheleciv Magazine
The Davis-Hodgkins House
The George Washington University
Washington 6, D. C.

From: ______________________

____

____

Here are a few comments for ALUMVIEWS on where I am working, what I'm doing and news of my family.

____

____

____

____

Degree and Date ______________________ **Fraternity** ______________________

SLIPSTICK SLAPSTICK

"Whoever told that guy he was a prof? He just doesn't know how to teach the stuff. Everybody hates him. Every time he tries to explain something he digresses so much that no one can understand what he's talking about. I think he ought to quit teaching and go back to the farm."

"Yeah, I flunked too."

"You must have had a terrific time last night: your eyes are sure bloodshot."

"You oughta see them from this side!"

Voice on Phone: "Bob Shaken is sick today and he can't come to class. He requested me to notify you."

Professor: "All right. Who is this speaking?"

Voice: "This is my roommate."

She: "Sir, I'll have you know that I intend to marry an engineer and a gentleman."

He: "You can't; that's bigamy."

"Now that we're engaged, Darling, you're going to give me a ring, aren't you?"

"Sure, kid, what's your phone number."

Teacher: "How much is four times three?"

Jimmy: "Twelve."

Teacher: "Correct! That's very good, Jimmy."

Jimmy: "Very good? Hell, that's perfect."

He: "What's purple, has four legs, and eats people?"

She: "What?"

He: "A four-legged, purple, people eater."

Traveler: "Give me a round-trip ticket."

Ticket agent: "Where to?"

Traveler: "Back here, you fool."

One day a little mouse was hurrying across a wheat field when suddenly it was scooped up by a big reaping machine. The poor little mouse was thrown from side to side and was finally tossed back on the field. Another little mouse happened upon his friend lying on the ground and asked him what had happened. "I've been reaped," came the reply.

Reader: "Do you make up those jokes yourself?"

W. W.:"Yep, out of my head."

Reader: "You must be."

An elderly woman driving nonchalantly down the street turned a corner and ran down a poor inebriated engineer. Without any show of emotion, she got out of the car and said. "You'd better watch out, young man." "Ye gads," groaned the drunk, "don't tell me you're going to back up?"

A woman approached the pearly gates and spoke to St. Peter. "Do you know if my husband is here? His name is Smith." "Madam," St. Peter admonished, "we have many Smiths here; you must be more specific." "William Smith," said the woman "Madam, you must be still more specific. Does he have any outstanding characteristics" "Well, he always said that if I was ever unfaithful to his name after he died that he would turn over in his grave." "Oh, of course," said St. Peter, "you must mean Whirling Willie Smith."

The ship was sinking and the Captain called all hands aft. "Who among you can pray?" he asked. "I can," replied an Ensign. "Then pray, shipmate," ordered the Captain. "The rest of you put on the life jackets. we're one short."

"He says I don't know how to dress, huh Well, tonight I'll wear my low cut dress and show him a thing or two."

Jack O. was very indignant at being arrested. He staggered into the Police Station and before the Captain had an opportunity to say anything he pounded his fist on the desk and said, "What I wanna know is why I've been arrested." "You were brought in for drinking," answered the Captain. "Well thass different—thass fine—let's get started."

A young engineer got a job in a remote mining camp. On his first day off, he approached the boss and said "Say, boss, what do you do around here for amusement?" "Why," replied the boss, "we usually watch Sam, the cook, drink a gallon mixture of whiskey, gasoline, and red peper juice. It's the funniest thing you ever saw. Why don't you come along?" The young engineer was obviously shocked. "No thanks," he said. "I don't go for that sort of stuff." "Well," answered the boss, "I sure wish you could come along. We could use your help." "Why" asked the engineer. "We need somebody to hold Sam. He don't go for that sort of stuff either."

One of a series*

Interview with General Electric's W. Scott Hill Manager—Engineering Recruiting

Qualities I Look For When Recruiting Engineers

Q. Mr. Hill, what can I do to get the most out of my job interviews?

A. You know, we have the same question. I would recommend that you have some information on what the company does and why you believe you have a contribution to make. Looking over company information in your placement office is helpful. Have in mind some of the things you would like to ask and try to anticipate questions that may refer to your specific interests.

Q. What information do you try to get during your interviews?

A. This is where we must fill in between the lines of the personnel forms. I try to find out why particular study programs have been followed, in order to learn basic motivations. I also try to find particular abilities in fields of science, or mathematics, or alternatively in the more practical courses, since these might not be apparent from personnel records. Throughout the interview we try to judge clarity of thinking since this also gives us some indication of ability and ultimate progress. One good way to judge a person, I find, is to ask myself: Would he be easy to work with and would I like to have him as my close associate?

Q. What part do first impressions play in your evaluation of people?

A. I think we all form a first impression when we meet anyone. Therefore, if a generally neat appearance is presented, I think it helps. It would indicate that you considered this important to yourself and had some pride in the way the interviewer might size you up.

Q. With only academic training as a background, how long will it be before I'll be handling responsible work?

A. Not long at all. If a man joins a training program, or is placed directly on an operating job, he gets assignments which let him work up to more responsible jobs. We are hiring people with definite consideration for their potential in either technical work or the management field, but their initial jobs will be important and responsible.

Q. How will the fact that I've had to work hard in my engineering studies, with no time for a lot of outside activities, affect my employment possibilities?

A. You're concerned, I'd guess, with all the talk of the quest for "well-rounded men." We do look for this characteristic, but being president of the student council isn't the only indication of this trait. Through talking with your professors, for example, we can determine who takes the active role in group projects and gets along well with other students in the class. This can be equally important in our judgment.

Q. How important are high scholastic grades in your decision to hire a man?

A. At G.E. we must have men who are technically competent. Your grades give us a pretty good indication of this and are also a measure of the way you have applied yourself. When we find someone whose grades are lower than might be expected from his other characteristics, we look into it to find out if there are circumstances which may have contributed.

Q. What consideration do you give work experience gained prior to graduation?

A. Often a man with summer work experience in his chosen academic field has a much better idea of what he wants to do. This helps us decide where he would be most likely to succeed or where he should start his career. Many students have had to work hard during college or summers, to support themselves. These men obviously have a motivating desire to become engineers that we find highly desirable.

Q. Do you feel that a man must know exactly what he wants to do when he is being interviewed?

A. No, I don't. It is helpful if he has thought enough about his interests to be able to discuss some general directions he is considering. For example, he might know whether he wants product engineering work, or the marketing of technical products, or the engineering associated with manufacturing. On G-E training programs, rotating assignments are designed to help men find out more about their true interests before they make their final choice.

Q. How do military commitments affect your recruiting?

A. Many young men today have military commitments when they graduate. We feel it is to their advantage and ours to accept employment after graduation and then fulfill their obligations. *We have a limited number of copies of a Department of Defense booklet describing, in detail, the many ways in which the latter can be done. Just write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y.* 959-8

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